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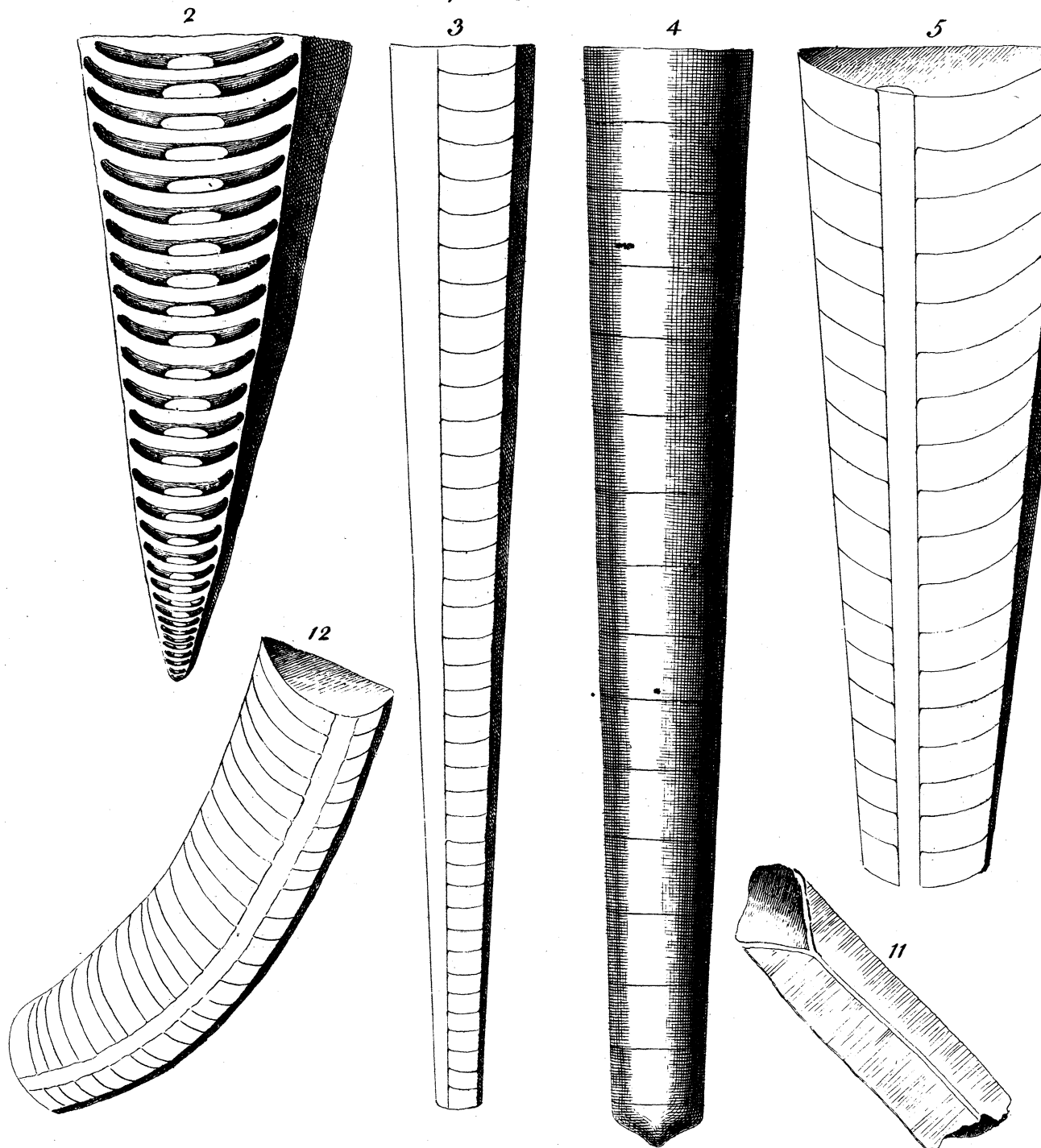
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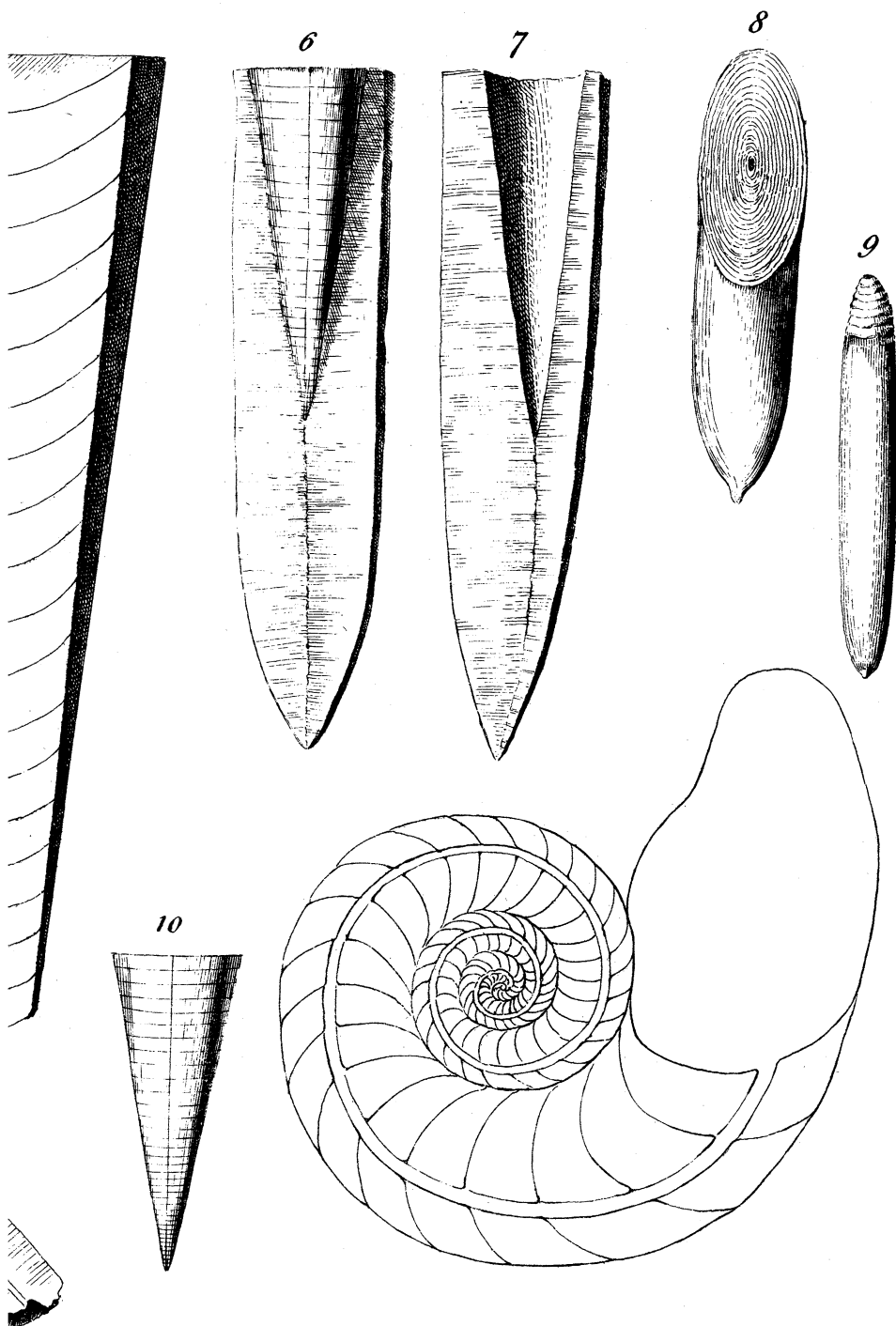
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J. Mynde sculp.

XCVII. *A Dissertation on the Belemnites, in a Letter to Smart Lethieullier, Esquire, F. R. S. by Mr. Gustavus Brander, F. R. S.*

S I R,

Read Nov. 21. 1754. **I**T is owing to the pleasure of some late conversations with you, upon the subject of natural history in general (in which I am always sure to profit), that I now take the liberty to offer you my sentiments concerning the belemnites.

The belemnites is a fossil, that has hitherto perplex'd the naturalists of all countries: it has been treated of by various authors, and in turn been ascribed to all the three kingdoms of nature; but, apprehending the road to truth still open, I am encouraged to resume the subject once more, and beg leave to deliver it as my opinion, that it belongs to the testaceous part of the animal kingdom, and to the family of the nautili. The nautilus, or sailor, is a concamerated shell, with a syphunculus running through every cell, see *Tab. XXXIV. Fig. 1.* The syphunculus, and the concamerations, are the generical character of this tribe, and are supposed to serve the animal to buoy up its shell, by which means it can swim or sink at pleasure.

Those that are curv'd are very common both in the recent and fossil state: the strait ones have hitherto only been met with fossil, and are common enough in Sweden, Livonia, and several parts of Germany; and have, by naturalists, been called orthoceratix;

thoceratitæ ; nay, I have seen some in Dr. Mafon's private collection at Cambridge, which he told me were found in England, and, I think, came from Whitby ; the character of which being exactly the same with the nautili, I make no scruple to class them together.

Whosoever will examine nicely bodies of any genera, will have a difficulty to say, where they begin, and where they end ; the gradation is so insensible, that they must be bewilder'd.

From the orthoceratitæ, which is undoubtedly a species of nautilus, we gradually proceed to the belemnites. The orthoceratites is a strait concamerated shell, ending in a point ; some of which I have seen in stone eighteen inches long ; see *Fig. 2, 3, 4, 5, and 12.*

The nucleus, or alveolus, of the belemnites is likewise a strait concamerated shell or body, exactly resembling the other in shape and structure, but of a smaller species, *Fig. 6 and 10* ; and, I think, from the very great analogy, may reasonably be deemed to be of the same family.

In the conic cavity of the belemnites, *Fig. 7.* that contains the nucleus, it is very common to observe visible marks of a shelly substance, as a farther confirmation that the nucleus was a testaceous body.

And now a word as to the belemnites itself, the counter-part to the other.

It has indeed been truly matter of speculation, how that huge solid substance called the belemnites, exclusive of the nucleus, could be formed ; and how it happens that some should have the nucleus within them, others not ; the cavity to contain the same in
some

some very small, in others scarce or not at all visible.

These, I think, are the main difficulties, all which I shall endeavour to elucidate; but must first acknowledge myself obliged to Monsieur de Peyssonnel, and particularly to my worthy and ingenious friend Mr. John Ellis, F. R. S. for their curious observations on the nature of coral, upon which this latter part of my hypothesis is founded. They have, I think, plainly demonstrated, that many bodies which we always took to be vegetable from their appearance, are really animal, and constructed by the polyp; and that several coralline substances, hitherto reputed marine plants, are thick beset with a prodigious quantity of seedling-shells (too small for the naked eye to see), close by each other, as diamonds in a bodkin, ready to come forth in due time out of their several nests or cellules; see Philosophical Transactions, Vol. 47. pag. 445. and Vol. 48. Tab. V. pag. 115. Whereupon I very humbly submit, if it is not highly probable that the testaceous tribe in general are generated like butterflies, and flies of all kinds, the one from a maggot, the other from a polyp? Nay, it appears presumptive to me, that it must be so with a great many. On which circumstances I proceed, that as corals in general, from late observation, seem to be constructed by polypi, what inconsistency then to believe them to be the primary state of all or most of the testaceous tribe? If so, it is almost beyond a conjecture, that the body called a belemnites (which, on being put into acids, is found to ferment in like manner as coral, and other creta-

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ceous bodies), is formed likewise by a polyp, from which the nucleus seems to be the ultimate state.

And I further submit, whether this concamerated shell, or body, of which the belemnites is only the habitation, does not appear a strong voucher for this new hypothesis, by more immediately leading us into the connexion and manner of generation (perhaps particular to the testaceous tribe) by remaining within its nidus all its life; whereas the generality quit them so soon as they are able to shift for themselves.

The polyp is an animal of the vermicular kind; the bodies of some are long and slender, like a fine sinew or fibre, extremely tender; and from the head proceeds a variety of claws, or arms, with which it catches its food, and prepares its habitation, or chrysalis. They are without doubt of various shapes and textures, according (as I suppose) to the species of the animal that is hereafter to proceed from them *; and very wonderful it is, how so small, so delicate an animal, should be capable of forming so large a body as the belemnites! but is not every particular performance of nature equally the same to a diligent inquirer? so that I conceive the less cause against this opinion; more especially as late authors have pretty clearly demonstrated, that corals of much greater magnitude are constructed by them. Some animals in the terrestrial part of the creation, naturally associate and herd together. Others again seek

* Mr. Henry Baker, F. R. S. has very ingeniously delineated a great variety of species of them, in his treatises on the polyp, and upon the microscope observed in fresh water.

solitude. The same dispositions we find impressed on those of the aquatic system: then why not among the polypi? as is evidently seen from the prodigious variety of coral bodies, where it seems in some as if thousands acted in concert together; in others, where each acts for itself; of which latter is the belemnites.

The shape of the belemnites is generally more or less conic, terminating in a point, and of various colours, according to the juices of the stratum in which it lay: it has usually a seam or fissure, running down the whole length of it, sometimes filled with a cretaceous substance. In some it is in the middle or axis of the body; in others on one side. Its interior constitution seems composed of several concoid cortices, or crusts, which, when broken transversely, appear to proceed in striæ or rays from the seam or centre; which seam I take to have been the habitation or cell of the animal in its polyp state, and in which the body was affixed; or perhaps serving as a syphunculus, in which was a ligament that proceeded from the nucleus in its perfect state.

The crusts that it is composed of, I should apprehend, denote certain periods in the age of the animal; as the annual rings in a piece of timber, its age: but what those periods are, we are unacquainted with; see *Fig. 7, 8, 9, and 11.*

The animals of the testaceous tribe in general, as they increase in age, increase their shell in thickness, until they have lived their stated time, or attained to good old age; and that is done by adding a new crust or lamina to it, as several, if not all the tubuli, the oysters, and the nautili, witness (but these observations are best made on fossil bodies, when, by great length

length of time the immediate cause of their adhesion becomes weakened, and displays to view their texture); after which they grow inactive and dull, the effect of extreme old age, suffering other marine bodies, as worms, oysters, &c. to penetrate and affix themselves to their outer coat. The like appearances we frequently meet with on belemnites, when the animal within, I suppose, was either wax'd old, or dead; and is an additional proof that the body is of marine origin.

Every one, that has made this part of natural history his study, must have observed, that the minutæ, or exceeding small fossil shells, very frequently occur, and in the greatest abundance, especially in fine loam or clay proper to preserve them: which shews that it was spring or spawning-time when the deluge overwhelm'd the country they were natives of. And that diminishes one of the difficulties concerning the belemnites, why some have the cavity, others not, or but very small: for may we not attribute these several appearances to the different ages of the animal; as in the spring or spawning-time, and some time after, a thousand small fish appear in the water to one grown to maturity, or seedlings on the shores of shell-fish, to one at full growth? and, from a parity of reasoning, is there not great likelihood to believe that every belemnite would have had a nucleus, if it had lived? and to suppose that deficiency to be caused by the deluge coming on, in the early part of the season, in that spot whereof they are natives, before they had attained perfection?

Not that I doubt of there being the same variety of species among the belemnites as of any other tribe
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in the testaceous kingdom, we are convinced of that : but let us, for argument sake, suppose, that many never would have had a nucleus, that still does not hinder, but that the body itself might be formed by a polype, only of a different species from those, that have the nucleus. And after all, if it should yet be objected, that the animal, though ever so small, would retain the exact shape of what it would be in future, let them have recourse to the fine collection of shells of my good friend Mr. Arthur Pond, F. R. S. where they may trace many families of shells from their minute state, and see the regular progressions of the animal, till it has attained full growth; by which it will appear, that the resemblance is often very small between their first and last state.

The country of the belemnites is unknown to us ; but there is great probability it is the same with that of the conchæ anomia in general, and ammonites ; since they are usually found together, and are well supposed to be the inhabitants of deep or unknown seas, beyond human reach.

And now, Sir, having had so frequent occasion to mention the orthoceratites in the course of this subject, they being here rare and uncommon fossils, I have given the figures of some few species of them, which perhaps may not be unacceptable, N^o 2, 3, 4, 5, and 12.

If it should be asked, whether they proceed likewise from a belemnites? I answer, that I suppose them to proceed from a polype like the rest, but whether their parent polype formed itself a belemnites-like chrysalis or habitation (being a stouter animal), is more than I can affirm, although very probable, as the terminating point in them is as sharp and fine

as the nucleus of the belemnites; and it is observed, that all the turbinated shells increase their circumvolutions from the point, or apex; but that is not the immediate business of the present purpose, as nature has many ways to compass her ends. My design will be answered, if it shall only be thought, that I have evinced the belemnites to be an animal production, formed by a polype, as other coralline bodies; and its nucleus to be a concamerated testaceous body, of the nautili genus, proceeding therefrom.

Such is my hypothesis of this hitherto not sufficiently explained body; which I candidly submit to better judgments, to approve or reject, as reason shall appear. I am, with perfect regard,

S I R,

London, Nov.
14, 1754.

Your most obedient humble servant,

Gustavus Brander.

Description of the PLATE.

- N^o 1. A section of a common nautilus.
 2, 3, 5, and 12. Sections of orthoceratitæ.
 4. An orthoceratites intire.
 6. A section of a belemnites, with the nucleus.
 7. Ditto, without the nucleus.
 8. An oblique section of a belemnites, to shew the inward structure.
 9. A belemnites without a cavity, only a small perforation.
 10. A nucleus of a belemnites.
 11. A belemnites, with a very small cavity.